EXHIBIT A

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

In Re: Methyl Tertiary Butyl Ether ("MTBE")
Products Liability Litigation

Master File No. 1:00 – 1898
MDL 1358 (SAS)

This Document relates to:

City of New York v. Amerada Hess Corp., et al., 04 Civ. 3417

EXPERT REPORT OF THOMAS F. MAGUIRE, PG, LSP, LEP

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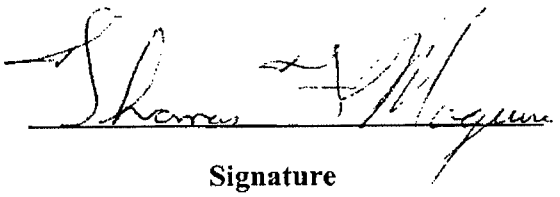

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Date

SECTION 2.0

OPINIONS

1. Opinions regarding the general fate and transport characteristics of Methyl tertiary-Butyl Ether (MTBE) were previously provided in my January 23, 2009 report. These characteristics, in part, dictate the nature, extent, and duration of ground-water impact resulting from releases of gasoline containing MTBE, and therefore are relevant with respect to identifying sources and predicting future impact on a well-by-well basis. To this end, rather than restate these opinions, they have been incorporated herein by reference.

2. The analyses conducted by Plaintiff's hydrogeologic experts Cohen/Bell and Terry rely upon the application of computer models including, but not limited to MODFLOW, MT3D, MODPATH, ATRANS, GMS and/or Groundwater Vistas. To date, electronic files regarding these analyses have not been provided. In the absence of these files a comprehensive assessment of the methodology and attendant opinions offered by Cohen/Bell and Terry cannot presently be made. Accordingly, it will be necessary (and therefore I reserve the opportunity) to supplement the opinions expressed herein, based upon a review of these electronic files.

3. The methods employed by Cohen/Bell and Terry to identify the source or sources responsible for the presence of Methyl tertiary-Butyl Ether (MTBE) in selected City of New York wells (i.e., "Focus Wells") is not endorsed in the relevant scientific literature as a deterministic method[1]. Rather the methodology is, at best, considered a "screening-level"[2] assessment and does not support findings or conclusions regarding the identification of contaminant sources to a public supply well to a reasonable degree of scientific certainty. In fact, Cohen/Bell and Terry present differing opinions regarding the sources for certain Focus wells. Moreover, as noted by the Plaintiff's experts, if releases of petroleum fuels containing MTBE (i.e., gasoline, diesel fuel and heating oil) have not been reported or investigated, they have not been considered in the analysis. To this end, the method is subject to selection bias; specifically, to the extent releases were not contained in information sources relied upon by Cohen/Bell and Terry.

4. The "screening level" assessment used by Cohen/Bell and Terry to identify sources of MTBE in the Focus Wells did not employ rigorous investigative or analytical methods generally accepted and required to identify the source of a supply well impact to a reasonable degree of scientific certainty. Site-specific data and multiple

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[1] In the context of this matter, a deterministic source assessment is capable of distinguishing with certainty a known source from a population of potential sources.

[2] A screening-level assessment represents the initial and rudimentary analysis in an iterative process designed to reduce uncertainty in the findings of a hydrogeologic investigation. As the initial phase of a hydrogeologic investigation, it is not intended to support findings or conclusions with certainty.

lines of evidence are required to conduct either a screening-level or deterministic assessment. With respect to a deterministic evaluation regarding the potential impact on the quality of ground water withdrawn from a public supply well, a robust and iterative analysis of site-specific empirical data including, but not limited to the following is required: a) a comprehensive assessment of the hydrostratigraphic conditions along the flow path between the release site(s) and the potential receptor well; b) sufficient temporal, spatial and lithologic data to assess the mass transfer rate and history (i.e., mass discharge) at the source(s); c) collection of general ground-water chemistry data at the source and along the flow path; d) a quantitative fate and transport assessment in the vadose and saturated zones including an analysis of the importance and rate of intrinsic attenuation processes; e) a determination regarding the location and potential hydraulic influence of ground-water recharge and discharge points (both anthropogenic [e.g., infiltration basins, leaking sewers and supply wells], and natural [e.g., formation outcrops area and stream/river locations]) along and adjacent to the contaminant flow path; f) the strength of vertical hydraulic gradients; g) the location and construction of the supply well; and h) an assessment of the impact of cyclical/episodic pumping (duty cycle) of supply wells on a seasonal basis or as dictated by demand.

5. For purposes of identifying sources of impact to the Focus Wells, Cohen/Bell and Terry equate "capture zones" with the "zone of recharge." A two dimensional (plan view) illustration of the "capture zone" (as produced by the MODFLOW analyses of Cohen/Bell and Terry) will not in all instances fairly represent the zone of recharge of a supply well. The zone of recharge is defined as the physical intersection between a wells capture zone and the surface of the water table (i.e., the point where surface recharge enters the capture zone, similarly where contamination released at the surface can enter a capture zone). In cases where the supply well is "partially penetrating", the aquifer matrix is not isotropic, and/or vertical movement of ground water is impeded, the "zone of recharge" will differ from the "capture zone." In these instances, a well's capture zone will overstate the area from which it will derive contamination from a surface release. This distinction is of particular importance when assessing the recharge zone for Well 5, which draws water from the Magothy aquifer.

6. The analysis relied upon by Mr. Terry to predict the concentration and duration of future MTBE impact on the Focus Wells is highly speculative and unreliable, in part, for the following reasons: a) the fidelity of the contaminant transport model was not tested through a calibration or validation process[3]; b) a robust sensitivity analysis

[3] The generally accepted method to test and verify the accuracy of a model (i.e., establish its fidelity) is to compare model predictions against known/measured data. This process is known as calibration and/or validation. Model calibration and validation should be conducted on independent data sets represented by different time periods or aquifer stresses. In this case, some of the Focus Wells reported the historical presence of MTBE. Yet, Mr. Terry made no apparent attempt to conduct retrospective simulations to calibrate or validate the contaminant transport model.

was not conducted[4]; c) in many instances the release date and/or volume were not known for individual sources; d) where release volumes were not known, plumes containing the equivalent MTBE content of a hypothetical and unsubstantiated volume of dissolved gasoline were assumed; e) source terms[5] in the numerical model analysis (i.e., MT3D) and certain analytical model analyses (ATRANS) appear[6] to have been represented as instantaneous (slug) releases rather than time-dependent rate limited mass flux terms; f) the dispersivity values employed by Mr. Terry are excessive; g) Mr. Terry's limited consideration of biodegradation[7] does not fairly reflect field studies regarding the aggregate effect of natural attenuation on MTBE plumes, h) an independent model analysis conducted by Malcolm Pirnie (on behalf of the City of New York) simulated substantially different MTBE concentrations in Station 6 wells than those predicted by Mr. Terry; and i) in the limited instances where Mr. Terry provides simulated MTBE concentrations prior to 2009 (Wells 5 and 39) there is no correspondence between the simulated concentrations resulting from his hypothetical 2,000 and 500 gallon gasoline discharge scenarios and observed/measured MTBE concentrations.

7. Generally, Mr. Terry's model analyses represent MTBE plumes as permanent fixtures affecting ground water quality in the Upper Glacial and Magothy aquifers beneath Queens over the next 40 years. In fact, as a function of: a) ground-water movement; b) natural attenuation processes; and c) site cleanup actions, empirical studies demonstrate that the spatial/temporal occurrence of significant MTBE concentrations is transient (diminishing with time) rather than permanent[8]. These data, in conjunction with the fact that New York State banned the use of MTBE as a gasoline additive starting in January 2004, indicate that to the extent MTBE has been released into the aquifers beneath Queens, concentrations will continue to diminish with time. These facts further render speculative any current conclusion regarding the presence

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[4] Mr. Terry notes that only the parameter dispersivity was subjected to a sensitivity analysis. Moreover, this is the same parameter upon which the model was purportedly "calibrated".

[5] The source term in either a numerical or analytical model is simply a mathematical algorithm through which contaminant mass is introduced into the model domain. The algorithm must closely approximate the natural processes that dictate contaminant mass transfer at the source. Moreover, the source term algorithm must honor site-specific spatial and temporal data regarding soil and water quality.

[6] The text of the Cohen/Bell and Terry reports is not adequate to fully describe the modeling exercises nor the input data utilized to identify sources and predict future impact in the selected wells. Moreover, as previously noted, electronic modeling files (including but not limited to MODFLOW, MT3D, MODPATH, ATRANS, GMS and/or Groundwater Vistas) have not been produced by Plaintiff's experts.

[7] Mr. Terry assumed a biodegradation ½ life of 10 years for the hypothetical 500 gallon gasoline release scenario, a biodegradation ½ life of 2 years for the 50 gallon release scenario and no biodegradation for the 2,000 gallon hypothetical release.

[8] The rate at which concentrations of MTBE diminish in a plume (as a result of the aggregate effect of natural attenuation and cleanup actions) is termed the decay rate. The US EPA has conservatively cited decay rates for MTBE plumes, in terms of ½ lives ranging from 0.35 to 1.3 years (EPA 2005 and Wilson and Kolhatkar, 2002).

refine the Cohen/Bell model domain and cell dimensions in the area of Station 6 to conduct contaminant transport analysis. In addition to large cell dimensions, regional models often incorporate a generalized representation of hydrostratigraphic conditions over large areas. To this end, localized heterogeneities and anisotropic conditions, which may exert significant control on the ground-water flow field, are ignored.

- **A complex historical pumping regime in the Upper Glacial and Magothy aquifers beneath Queens.** As noted by Cohen/Bell, the complex history of pumping in Queens County produced a "highly variable flow field." Accordingly, the "capture zones changed significantly depending upon the time when the backward particle tracking begins." To address this issue, Cohen/Bell defined "composite" capture zones that aggregated multiple and, in some cases, disparate particle tracks. Moreover, as noted by Cohen/Bell, "the records for most commercial and industrial sources of pumping in Kings, Queens and Nassau Counties are generally poor."

- **Zones of recharge ("source water zone") were not distinguished from the "composite capture zones" identified by Cohen/Bell and Terry.** A capture zone is defined by the flow paths that ground-water will theoretically traverse from the point of recharge to the intake (screen) of the pumping well, irrespective of the depth below the ground-water surface. The "zone of recharge" is the intersection between the capture zone and the surface of the water table where the source water for the well is derived through precipitation recharge. The zone of recharge represents the area where surface releases of contamination can enter the capture zone of the well. In fact, when the supply well is: "partially penetrating" (i.e., the screen doesn't extend to the surface of the water table and over the entire thickness of the aquifer); the aquifer matrix is not isotropic (exhibiting uniform characteristics in all directions – i.e., homogeneous); and/or the vertical movement of ground water is impeded (relative to horizontal flow) in the aquifer, the "zone of recharge" will be distinctly different and likely separated from the location of the supply well.

- **The ground-water flow model was not subjected to a transient calibration nor was it validated against a data set reflecting hydraulic conditions different than those represented by a 1991 steady state.** As noted by Cohen/Bell, the ground-water flow model (MODFLOW) was calibrated against 1991 steady state conditions (intended to represent a period from 1990 through 1998 when the water levels were relatively stable). During the period 1990 through 1998 none of the Station 6 wells was pumped (Wells 6, 6A, 6B, 6D) and, with limited and transient exceptions, Well 33 was not pumped during this period. Similarly, Wells 26 and 39 were not pumped during the period 1990 to 1998. Therefore, the 1991 steady state conditions upon which the ground-water flow model was calibrated did not consider the effects of pumping the majority of the Focus Wells. With respect to calibrating ground-water flow models, it is a standard practice to subject a "calibrated" model to a different set of hydraulic

As noted by Cohen/Bell, sites (including those with registered USTs) located within and/or adjacent to the composite capture zones that do not have reported gasoline spills (including City of New York facilities) could have had discharges of gasoline or other petroleum products containing MTBE (e.g., diesel and fuel oil). For this reason, the "inventory" of potential sources assembled by Cohen/Bell and Terry represents a censored data set and therefore is subject to selection bias.

Other sources of uncertainty with respect to the second step of the Cohen/Bell method to identify sources include:

- **No apparent rigorous assessment of the source term characteristics at all identified potential source locations.** An informal/qualitative assessment, if any, appears to have been made regarding the spatial distribution, residual source mass and MTBE mass flux at each potential source site. There are generally accepted methods to quantitatively assess the magnitude and strength of a contaminant source. A quantitative assessment of the source characteristics is a critical element with regard to identifying the contaminant source for a supply well.

- **No consideration regarding the natural attenuation potential of MTBE along the hypothetical flow path from a potential source to the Focus Well.** Mr. Terry apparently did not consider the effect of biological degradation or other natural MTBE attenuation processes in conjunction with his MT3D analysis for Station 6 wells. In addition, although Mr. Terry incorporated biodegradation ½ lives (but no other natural attenuation mechanisms) into his hypothetical 50 and 500 gallon dissolved gasoline ATRANS scenarios, his findings regarding "reasonable" future MTBE concentrations in the Focus wells principally relied upon his 2,000 gallon release, which did not incorporate biological degradation.

- **No quantitative fate and transport analysis was made in an attempt to validate hypotheses regarding potential sources.** Although Mr. Terry conducted a prospective fate and transport analysis, predicting future MTBE concentrations in Focus Wells, no attempt was made to conduct a retrospective analysis to confirm the timing and magnitude of historical impacts from identified sources. In fact, it appears that Mr. Terry made a concerted effort to avoid presenting results of his fate and transport analyses prior to 2009 as evident by the truncated nature of his simulated breakthrough curves for most of the Focus Wells. As with ground-water flow models, industry standards require that contaminant transport models be subjected to a rigorous calibration and validation process to test, establish and document the fidelity of the model predictions. In two instances, Wells 5 and 39, Mr. Terry did provide simulated results prior to 2009. As discussed in greater detail below, there is no correspondence between Mr. Terry's simulated concentrations resulting from his hypothetical 2,000 and 500 gallon gasoline discharge scenarios and observed/measured MTBE concentrations in these two wells.

Given the screening-level nature and considering the above-noted uncertainties associated with both steps of the source identification method, it is my opinion that neither Cohen/Bell nor Terry can identify the source or sources responsible for historic or predicted future MTBE impacts on the Focus Wells to a reasonable degree of scientific certainty.

3.2 Predicted MTBE Concentrations (David Terry, PG)

The analysis relied upon by Mr. Terry to predict the concentration and duration of future MTBE impact on the Focus Wells is highly speculative and unreliable, in part, for the following: a) the fidelity of the contaminant transport model was not tested through a calibration or validation process; b) a robust sensitivity analysis was not conducted; c) in many instances the release date and/or volume were not known for individual sources; d) where release volumes were unknown, plumes containing the equivalent MTBE content of an unsubstantiated volume of dissolved gasoline were assumed; e) sources in the numerical model analysis (MODFLOW) and some analytical model simulations (ATRANS) appear to have been represented as instantaneous (slug) releases rather than time-dependent rate limited mass flux terms; f) the dispersivity values employed by Mr. Terry are excessive; g) Mr. Terry's limited consideration of biodegradation does not fairly reflect field studies regarding the aggregate effect of natural attenuation on MTBE plumes, h) an independent model analysis conducted by Malcolm Pirnie (on behalf of the City of New York) simulated substantially different MTBE concentrations in Station 6 wells than those predicted by Mr. Terry; and i) in the limited instances where Mr. Terry provides simulated MTBE concentrations prior to 2009 (Wells 5 and 39) there is no correspondence between the simulated concentrations resulting from his hypothetical 2,000 and 500 gallon gasoline discharge scenarios and observed/measured MTBE concentrations.

- **Contaminant transport models were not calibrated or validated.** The generally accepted method to test and verify the accuracy of a model (i.e., establish its fidelity) is to compare model predictions against known/measured data. This process is known as calibration and/or validation. Calibration and validation of both the ground-water flow model (MODFLOW) and the contaminant transport model (MT3D) should be conducted on independent data sets represented by different time periods or aquifer stresses. As previously noted, the MODFLOW model utilized by Mr. Terry to predict future MTBE concentrations in Station 6 wells (Wells 6, 6A, 6B, 6D and 33) was not subjected to a rigorous calibration. Most significantly, the 1991 steady state data set upon which this model was purportedly calibrated did not consider pumping in Station 6 wells. To this end, the attendant uncertainty in the underlying ground-water flow model is propagated into the contaminant transport model (MT3D), affecting the accuracy of Mr. Terry's predictions at the outset (i.e., without considering additional sources of uncertainty in the MT3D model). No calibration or validation was provided or discussed for the ATRANS model simulations.

The rate at which concentrations of MTBE diminish in a plume (as a result of the aggregate effect of natural attenuation and cleanup actions) is termed the decay rate. The US EPA has conservatively cited decay rates for MTBE plumes, in terms of ½ lives ranging from 0.35 to 1.3 years (EPA 2005 and Wilson and Kolhatkar, 2002).

- **An independent model analysis conducted by Malcolm Pirnie (on behalf of the City of New York) predicted substantially different MTBE concentrations in Station 6 wells than those simulated by Mr. Terry.** In conjunction with various Dependability Study projects, the City commissioned Malcolm Pirnie, Inc. (MPI) to predict future MTBE concentrations in Station 6 wells. In response to this request, MPI conducted a fate and transport analysis employing MODFLOW and MT3D models. MPI utilized the same technique as Mr. Terry to introduce MTBE mass into the model. Specifically, MPI started the model analysis with an initial dispersed distribution of MTBE, allowed the MTBE mass to move in response the hydrostatic aquifer conditions (i.e., no pumping from Station 6 wells) for three years and then initiated pumping at Station 6 wells. Output from the MPI "worst-case" MTBE model for Wells 6B and 6D are presented in Figures 1 and 2. In comparison, Mr. Terry's "Analysis 1" predicted MTBE concentrations (Terry Figure 7) are plotted for the same wells.

  A comparison of the predictions made by MPI and Mr. Terry regarding future MTBE concentrations in Station 6 wells (Figures 1 and 2) reveals substantial differences. These differences highlight the uncertainty attendant with deterministic ground-water flow and contaminant transport modeling. Neither MPI nor Mr. Terry conducted a stochastic or probabilistic analysis to assess the effect that the intrinsic variability of requisite model input parameters has on their predictions. In the absence of this analysis, rates of error or confidence intervals cannot be assigned to the predictions.

- **An attempt to calibrate/validate Mr. Terry's contaminant transport model produces no correspondence between simulated and historically measured MTBE concentrations in Wells 5 and 39.** Terry Figures 14 and 15 provide model output from his contaminant transport analysis for Well 5. Specifically, Terry Figure 14 depicts the predicted MTBE concentrations in Well 5 attributed to releases at source site D-002 (211-60 Hillside Avenue). Similarly, Terry Figure 15 depicts the predicted MTBE concentrations in Well 5 attributed to releases at source site D-003 (211-02 Jamaica Avenue). These graphs represent the few instances[12] that afford an opportunity to compare Mr. Terry's predictions against measured data. Moreover, in light of the fact that Well 5 continued to pump through 2007, a retrospective analysis of this well is particularly germane to Mr. Terry's prospective predictions regarding MTBE concentrations under the hypothetical future pumping scenario.

[12] Without Mr. Terry's electronic files, a critical analysis of his models is limited to interpretation of the text and graphs included in his report. A more comprehensive analysis of Mr. Terry's models can be conducted once the electronic files have been received.